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THESIS

NAVAL TECHNOLOGY TRANSFER AND ARMS TRADE: THE BRAZILIAN CONNECTION

by

Sandra Nichols Ellis

June 1988

Thesis Advisor: Robert Looney
Second Reader: Joseph Sternberg

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Naval Technology Transfer and Arms Trade: The Brazilian Connection

by
Sandra N. Ellis
Lieutenant, United States Navy,
B.A., William Jewell College, 1975

Submitted in partial fulfillment of the
requirements for the degrees of

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Technology transfer and acquisition have become hotly debated and controversial policy issues. Examination of U. S. policy toward transfer of naval technology to Brazil raises questions of American national security and the validity of the Brazilian requests. Research reveals a history of dependence on the U. S. Navy and that the Brazilian naval industry also lags behind its military counterparts in domestic production, purchasing most naval equipment from abroad.

This paper examines the dependence of the Brazilian Navy on foreign navies and investigates the naval industry production problems. The U. S./Brazilian relationship reveals a partnership that could be reinforced by making U. S. technology transfer policies more flexible.

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I. INTRODUCTION

Why is naval technology transfer, arms trade, and the Brazilian connection of interest to the U. S.? Why are the strengths and capabilities of the Brazilian Navy important to the U. S. Navy? How important are the technology transfers between the two navies and why should these transfers be encouraged?

The Brazilian Navy and the U. S. Navy have enjoyed a long and mutually beneficial association. The support the Brazilian Navy provided in World Wars I and II was vital to the U. S. war efforts. The close alliance continued after the war. Officer exchanges, joint education and the naval training and exercises fostered familiarity and respect.

The U. S. Maritime Strategy now leads the U. S. to once again rediscover the neglected potential of the Brazilian Navy. Including the South Atlantic in the Maritime Strategy and realizing that Brazil is the premier naval power in the area, emphasizes the importance of a strong and capable Brazilian Navy.

The capabilities of the Brazilian Navy must then be a major concern. Since World War II Brazil has relied primarily on the U. S. for naval equipment and training. Changing political circumstances caused the U. S. to withdraw naval support. Brazil suffered neglect and has been forced to make do with an aging fleet. Only recently, because Brazil turned to Europe for naval technology, has the Brazilian Navy begun to modernize.

The U. S. must now reexamine its priorities and policies towards Brazil. The naval technology and training enabling the navy to accomplish projected missions must be made available if Brazil is to be included in a South Atlantic Maritime Strategy. The U. S. should reconsider naval technology transfer decisions which

have denied Brazil the naval equipment it desires. As U. S. naval strategy expands south, U. S. perceptions must not be blinded by technological irresolution.

A. BACKGROUND

> During the last four decades modern technology has become one of the primary sources of national power, prosperity, and strategy. Technology's impact on international relations has in fact been paradoxical: it has at once fostered interdependence and cooperation and sharply divided nations by heightening national competition and enabling greater global projection of power. [Bertsch and McIntyre, 1983, p. 1]

> The most tyrannical kind of dependence is military technological dependence. [Ronfeldt and Sereseres, 1979, p. 135]

> In the world arms trade, there is a growing emphasis on technology acquisition in place of the purchase of completed weapons systems...In reality, as more technology has been transferred to nations that previously purchased all their arms, they have become supplying nations. [Louscher and Salomone, 1987a, pp. 101, 105]

The surprising increase in the past decade of arms exports from Third World Countries has generated much discussion and alarm. The primary concern at first was the possibility that such a rise of arms merchants would be destabilizing and cause an increase in conflicts as the availability of weapons increased and the competition caused prices to drop.

A secondary concern was the economic changes caused by the development of this indigenous production capability. As lesser developed countries began to mature and cultivate their indigenous industries, they discovered that imported civilian technology was not only useful but enhanced military industrial capabilities as well. Thus the industrialized countries became aware that any type of technology transfer could potentially be useful in strengthening a recipient country's military establishment. Technology transfer became a hotly debated event and transfer of military equipment or capability became even more controversial.

The case of Brazil as an arms supplier poses interesting questions. Brazil has often been cited as one of the most successful arms suppliers to bring its wares to the market. Brazil can boast of 25 clients, more than any other Third World arms supplier and has the added advantage of having had some of its weapons designs thoroughly tested on the battlefield. Brazil is one of the ten largest exporters of major weapons systems in the world. [Brzoska and Ohlson, 1987, p. 112-115]

In examining the Brazilian naval industry, it can be immediately assumed that it is quite active and as successful as its military counterparts, the Army and the Air Force. Brazil has the second largest ship-building industry in the world, after Japan, and has had a very long and close relationship with the United States Navy. The first U. S. Naval mission established was in Brazil in 1922. Since that time Brazil has received significant amounts of U. S. naval equipment, training, and postgraduate and senior service college education in the United States. Brazil also maintains the most active bilateral naval exercise posture of all Latin American navies, and engages in an active and dynamic bilateral maritime strategy dialogue with its American counterpart.

However, closer examination reveals that the Brazilian Navy lags behind its military counterparts in domestic arms production, produces little indigenously, and purchases most of its equipment from abroad. It is this anomaly which this paper will examine.

B. ISSUES

Should U. S. policy towards transfer of naval technology to Brazil be revised, and if so, in what manner?

To answer this question several issues need to be addressed.

- What is the dependence of the Brazilian Navy on the American Navy and has this dependence increased or decreased over time? What effect has this dependence had on the Brazilian naval industry?
- How did the Brazilian defense industry begin and what were the rationales used by the Brazilian government to promote domestic military industrial growth and expansion?
- How has Brazil's technology transfer and acquisition process affected its relationshiop with the U. S.?
- What are U. S. interests towards Brazil as a naval power and how can America promote these interests?

These issues are best seen in an historical context. Chapter One surveys the naval history of Brazil. Particular attention is given to Brazil's relationship with the U. S. Navy.

Chapter Two assesses the evolution of the Brazilian defense industry. The technology transfer and acquisition plans employed by the government are appraised and the role of the navy in the government is examined.

Chapter Three researches the U. S./Brazilian relationship over the last ten to 15 years, investigating the principle events that have affected naval affiliation.

The conclusion offers alternatives to present American policies, in hopes of effecting positive changes in U. S./Brazilian naval affairs.

C. SOURCES.

Data used in this paper comes from several sources. Dollar value data on arms transfers was obtained from the following sources: *World Military Expenditures and Arms Transfers* (WMEAT); Stockholm International Peace Research Institute's (SIPRI) *Yearbook*: and the U. S. Government's publication on *Foreign Military Sales Agreements*. Weapons production capability was obtained from *Jane's Fighting Ships*. The updated information on Brazilian naval imports, exports

exports and weapons agreements was obtained from SIPRI Yearbooks 1983 through 1987.

Though these sources are widely used and considered valid, it is necessary to note that the measurement of technology transfer is difficult at best. Most countries do not publish the details of their military agreements. As Louscher and Salomone indicate,

> License and coproduction agreements can vary from simple assembly to joint ventures to factory and system blueprints. The exact nature of each agreement is generally proprietary and not open to public scrutiny. Therefore some of the agreements lumped here under the rubric of licenses may transfer more or less technology than is implied More specific information cannot be known, but all such agreements here indicate a transfer of more information than the sale of a completed system and more technical information than was previously possessed by the recipient. Any license or coproduction agreement no doubt transfers some knowledge. [Louscher and Salomone, 1987a, p. 111]

Though contracts or orders may be announced, the specific agreements which allow for the technology transfer to take place, such as technician-to-technician training, license purchase, or sale of designs, are nearly impossible to quantify. Therefore some of the transfers must be deduced without the benefit of a direct connection between an agreement and the transfer. These assumptions can be approximately measured in the quality and success of the final product exported.

D. LITERATURE REVIEW

Several sources have addressed the issue of technology transfer and security assistance. Louscher and Salomone [1987b] associated U. S. security assistance policies with the transfer of military technology used to enhance the military industries of Third World Countries. They indicated that this type of transfer is vital to lesser developed countries and played an important role in building the

indigenous military industrial base. Neuman [1986, p. 126] also examined the relationship but determined that such transfers are inconsequential because the superpowers have retained control over the quality of technological sophistication of the transfers. However, trade between the second-tier suppliers, such as Brazil and China, is transferring militarily significant technology that may increase the level of sophistication in certain areas for both countries.

Moodie [Neuman and Harkavy, eds., 1979] outlined the stages developing countries usually go through in developing indigenous defense industries. Graham [Louscher and Salomone, eds., 1987a, pp. 218-222] discussed the mechanism for commercial technology transfer.

Gray [1982] told a fascinating history of U. S. Navy involvement with Brazil, and Ferreira [1983] gave the history of the Brazilian Navy from the Brazilian point of view.

An excellent discussion of arms and technology transfer policies can be found in *Balancing the National Interest.* [National Academy of Sciences, 1987] A detailed examination of Brazil's industrial development is in Gwynnes's [1987] book.

For additional information on the Brazilian as well as other Latin American Navies, Scheina's [1987] *Latin America* provides a detailed history. Faltas' [1987] study of European navies supplied background for understanding the European naval market. A more in depth look at U. S. decisionmaking for arms sales is in *The Reluctant Supplier* [Hammond and others, 1983]

II. THE NAVY OF BRAZIL

A. INTRODUCTION

Brazil's naval history chronicles the long dependence the Brazilian Navy has had on foreign navies, particularly the American Navy. U. S. conduct and naval policies in the Latin American region encouraged Brazil's reliance. Transfer of naval ships and systems from the U. S. to Brazil necessitated transfer of training, operational skills, tactics, and even the transfer of naval missions. Ultimately, changes in American policies created an unacceptable level of dependence and Brazil found itself unable to procure naval equipment. Finally, to sustain the navy, Brazil was forced to consider alternative sources of assistance. European shipyards found a willing client and avidly filled the naval gap left by the U. S.

B. BRAZIL'S NAVAL HISTORY

The Brazilian Navy has a long and interesting record. Actual shipbuilding started in the 18th century. The most important shipyards were built in Rio de Janeiro, Salvador and Belem do Para. The facility in Rio began operations in 1763 and is the largest naval shipbuilder in the country today. [Ferreira, 1983, p. 4]

In 1822 the Brazilian fleet was in poor condition. The ships were in bad shape and were ill armed. They were also poorly commanded and manned due to the inexperience and lack of resolve of the officers and crews. To remedy this situation, Brazil hired foreign officers and sailors to help reorganize the navy. The British were asked to help revamp the fleet and Admiral Lord Cochane soon had the fleet conducting successful operations along the Brazilian coast. [Ferreira, 1983, p. 6]

In a conflict with Paraguay that lasted from 1865 to 1870, the Brazilian Navy took part in one of the the most important and most difficult engagements faced by the Brazilian Armed Forces in the 19th century. The navy struggled for control of the Paraguay and Parana Rivers, and encountered several problems. First, the seamen had little experience in riverine warfare. Second, there were no ships in the navy suitable for river operations. Finally, the Paraguayan Navy had assembled a strong river fleet and fortified strongholds along the river. [Ferreira, 1983, p. 7]

Brazil thus found it necessary to build, equip, and train an almost new fleet and provide logistic support for ships operating about 2000 miles from the home port in Rio de Janeiro. Brazil placed orders to shipbuilders from France and Great Britain, but also built warships in its own shipyards. By the end of this war the Brazilian Navy, as one author noted, ranked among the most powerful in the world. [Ferreira, 1983, p. 7-8]

After 1870 however, the Brazilian Navy declined in power for several reasons. There were no external conflicts and all border disputes were resolved through diplomacy. The Brazilian economy remained primarily based on agricultural production and little emphasis was given to industrialization. The technological based gained by the war effort was lost and the Brazilian Armed Forces chose to import almost all their hardware. [Ferreira, 1983, p. 7]

C. REGIONAL AND OUTSIDE INFLUENCES ON THE BRAZILIAN NAVY

By the turn of the century, Argentina was becoming a rich and powerful nation. Brazil and Argentina became involved in an arms race and both navies placed major orders with European shipyards. Between 1908 and 1910 the Brazilian Navy acquired two battleships, two cruisers, six destroyers, and one

support ship from England. Italy supplied three coastal submarines and a mother ship by 1914. With this new fleet, tactics, logistics, and technical skills were all improved. But the country still lacked an industrial base and dependence on foreign support was almost absolute. [Ferreira, 1983, p. 9]

During World War I, the Brazilian ships joined with the allied nations against the Central Powers. The Navy still experienced trouble because it had very little home port support. The navy continued to try to become more self-sufficient but did not build a single warship in the country during the next two decades. [Ferreira, 1983, p. 9]

As the British Navy declined at sea, so did their influence on the Brazilian Navy. The United States Navy replaced the British Navy as Brazil's mentor. The establishment of the U. S. Naval Mission in Brazil in 1922 increased U. S. presence. The stated purpose of this mission was to

> cooperate with the Minister of the Navy and with the officers of the Navy in whatever may be necessary to secure a good organization of the Navy ashore and afloat; in improving the methods of work in the shops, the shore establishment and on board ships; in training and instructing the personnel; and in drawing up and executing plans for the improvement of the Navy for fleet exercises and naval operations. [Ferreira, 1983, p. 10]

At the beginning of World War II, Brazil had a modernization program underway, building three destroyers of U. S. design in Rio and placing orders with Great Britain for six more destroyers. When England could not deliver the destroyers because of the war, the decision was made to build the ships in Brazil, using British hull plans, but installing American equipment. Thus the Brazilian Navy became almost exclusively dependent on the U. S. for the next 25 years. [Ferreira, 1983, p. 10]

In 1942, the Brazilian Navy was placed under the operational control of the U. S. Navy. It provided safe escort for hundreds of cargo ships. This interaction established naval and air bases, radio stations, and training facilities all along the Brazilian coast. Additionally, the Brazilian Navy received escort ships, ammunition, spare parts, technical assistance, and training from the U. S. Navy. This integration led to a modernization of the Brazilian Navy at all levels and dependence on the U. S. Navy increased. [Ferreira, 1983, p. 11]

At the end of World War II, Brazil remained an underdeveloped country. Agriculture still formed the economic base and industry was just beginning to develop. Beginning in 1956, the Brazilian government initiated several measures to improve the country's industry. Energy, transportation, industrialization and education received increased emphasis. [Ferreira, 1983, p. 16]

Brazil's geographic location and the fact that most of its foreign trade was and still is transported by sea, persuaded the government to find an alternative to buying ships abroad. The decision was made to build merchant ships in the country and in the last 20 years, Brazil has become one of the world's leading merchant shipbuilders. Many private shipyards were established or expanded, financed by both foreign and domestic capital, and used imported or indigenously-developed technology. [Ferreira, 1983, p. 18-19]

After World War II, the Brazilian Armed Forces copied the thinking, organization, material, training, and readiness of the U. S. Armed Forces. Ships, weapons, tactics, and strategic concepts were derived from the United States Navy and based on the thought that the next war would be global. [Ferreira, 1983, p. 22-23]

Brazilian leaders, including the military, began to find that excessive dependence on U. S. policies and strategic thinking could be inconvenient when pursuing Brazil's objectives. One particular area of discord was military sales and security assistance. The armed forces found increasing difficulties in attempting to replace their U. S. equipment with more modern versions and were finally forced to take their orders to the European market. This action opened new alternatives and offered less restrictions than U. S. military sales agreements. [Ferreira, 1983, p. 24]

D. THE ROLE OF THE NAVY IN GOVERNMENT

The Brazilian Navy has not been the most influential military branch in the country. Instead, the Army, because of its size, deployment, and historical importance, has been the senior service. Especially in larger political issues, the Army has prevailed over the Navy and Air Force. This influence is most pronounced when it is noted that the President of Brazil from the coup in 1964 until 1985 has been an Army general. [Nyrop, ed., 1983, pp. 249, 310]

The dominance of the Army and the relative lack of influence of the Navy became more pronounced after the revolt on March 31, 1964. This revolt was instigated by a navy-related incident which polarized the military into two factions, one supporting the regime in power, the other calling for major changes in military and other policies. When President Goulart refused to support the senior military officers' position, the Army moved to seize the government. [Nyrop, ed., 1983, p. 66-67]

The Army's preeminence can also be traced to the importance placed on Rio de Janeiro. This city has been the traditional center of the entire country, in economics, politics, and culture. Thus the service that guards it, the Army, has had

the best troops and the most modern equipment. Additionally, the commander of the Army division in Rio has wielded enormous power. [Nyrop, ed., 1983, p. 310-311]

The dominance enjoyed by the Army and the secondary role of the Navy evolved because the major threats to Brazil have not been from the sea, but have come from her continental neighbors in the south. The armies guarding the southern regions, considered strategically important by Brazil, and the scene of many hard-fought wars in the past, have had priority in manning and equipment. [Nyrop, ed., 1983, p. 311]

E. U. S. NAVY POLICY TOWARD LATIN AMERICA AND BRAZIL--1818 TO 1950

The U. S. Navy has had missions involving Latin America since 1818. Even at that early date these missions were expressed in terms familiar today, protecting U. S. national security interests. Though the methods for carrying out these missions may have changed, the missions themselves are still seen as vital to U. S. interests. [Gray, 1982, p. 3]

With government attention concentrating on the INF Treaty and its possible effects on NATO, it is easy to downplay the strategic importance of Latin America. However, in certain NATO wargame scenarios, Latin America becomes important, particularly if access to the North Atlantic is denied the U. S. and its allies. In this case, the southern sea lines of communication would be vital to allow continued shipments of resources between continents. [Gray, 1982, p. 2]

The U. S. also has a long history of intervention in Latin America. In 1906 Brazil placed an order with Great Britain for two dreadnaughts. When Argentina became concerned and began to also build up its military, President Roosevelt

appealed to Brazil, unsuccessfully, to stop buying naval arms. The Taft administration took a different approach, actually encouraging the American shipyards to enter into competition with the European shipyards and bid for Latin American contracts. Secretary of State Knox established the Bureau of Latin American Affairs at the State Department and convinced Congress to appropriate the funds to encourage U. S. firms to develop export trade. This policy resulted in two ships being built for Argentina by the Ford River Shipyard in Quincy, Massachusetts, between 1910 and 1914. [Gray, 1982, p. 41]

The first U. S. Naval Attache in Latin America was posted to Brazil in 1910, the U. S. Commission to Brazil was established in 1918. The purpose of the Commission was to build up and increase the efficiency of the naval strength of Brazil as well as to educate and train naval personnel, encourage the use of standardized materials, and foster friendly relations. At this time however, there were no provisions made for transferring arms. [Gray, 1982, p. 53-60]

The U. S. Naval Mission became most influential in Brazilian naval development between World War I and World War II. The senior Brazilian Naval officers were convinced the U. S. Navy was second to none and began to look routinely to the U. S. Navy for help. In 1921 the Brazilian battleships the *Sao Paulo* and *Minas Gerais* were modernized in the U. S. at a cost to the Brazilian government of $10 million. Additionally the weapons batteries were calibrated, and under U. S. naval supervision the battleships conducted modern target practice for the first time. Brazilian officers of the two battleships took orientation cruises on American battleships and were sent to U. S. Navy service schools for training. U. S. naval publications were translated into Portuguese, Brazilian naval aviators

were trained in the America, and new aviation equipment was purchased. [Gray, 1982, pp. 123-124]

By 1928, the U. S. Mission had made major changes to the Brazilian Navy. The Mission had assisted in the development of an industrial capacity which allowed the Brazilian Navy to build destroyers of U. S. design. This assistance in building destroyers is the earliest example of naval technical transfer and coproduction between the American Navy and Brazil. Tactical instructions applicable to the needs of the Brazilian Navy were prepared in Portuguese, and various other technical publications were translated and published as well. American technical assistance was provided in nearly every naval activity, including advice on the construction of a large drydock. Finally, the Brazilian Naval War College was reorganized along the lines of the U. S. Naval War College. [Gray, 1982, pp. 132-136]

In 1934, the Nye Commission reported that the U. S. Naval Mission in Brazil provided business for the U. S. munitions industries, increased the potential for conflict in Latin America, and did not advance the cause of peace. This investigation was prompted by the disagreement in the American government on how U. S. naval power should be used in South America. By 1936, however, attitudes had changed. The State Department declared that it would be preferable if 'other' governments in the Western Hemisphere, meaning Brazil, would get military assistance from the U. S. rather than someone else. The increasing influence of Germany, Italy and Japan was seen as threatening to American interests, but the U. S. military was unable to convince the politicians of the seriousness of the threat. [Gray, 1982, pp. 169-170]

In 1937, the Lend-Lease Bill authorized the American Secretaries of War and Navy to assist governments of Latin American republics to increase their military and naval establishments. The bill allowed U. S. naval yards and arsenals to contract for production of ships and weapons, standardize equipment, and sell arms to South American countries for the same prices that they were sold to the U. S. military. [Gray, 1982, p. 171]

There were protests to this bill. Many felt it would make an "arms huckster" out of Uncle Sam. There was also concern that this action would arm the Latin American countries against each other. With the advent of World War II, the bill was finally passed in 1940, but it was too late to allocate any U. S. resources to Latin America by this time. [Gray, 1982, pp. 172-173]

United States concern for preventing territories in the Americas from falling under European domination began to mount as war approached in Europe. At the Havana Conference in 1940, the Doctrine of Reciprocal Assistance and Cooperation was signed. It contained the following guidance:

- The U. S. would assist with armed forces if Latin America was attacked or requested such assistance.
- The U. S. would provide arms, equipment, training and advisors by providing stores directly or making the manufacturing capability in government plants available.
- The amount and type of aid would be situation-dependent. [Gray, 1982, pp. 174-175]

As a result of the Lend-Lease Act, the Brazilian Navy received 8 patrol craft, 8 submarine chasers, 8 destroyers, and miscellaneous other small boats, and aircraft. [Gray, 1982, p. 225-226]

World Wars I and II convinced America of the following realities:

- The South Atlantic was strategically important.

- There was danger of enemy penetration in areas of instability close to the U. S. such as Latin America, and
- There was a need for an efficient naval presence in the South Atlantic [Gray, 1982, pp. 106-107, pp. 250-251]

F. SUMMARY

Practically from the beginning Brazil relied on other countries for naval personnel, training, and equipment. The long frustrating dependence on other navies became a habit, too often leaving Brazil at the mercy of erratic political winds.

The Army still dominates the service branches. Even the Argentine naval failure in the Falklands/Malvinas War has apparently not helped the Brazilian Navy modernize as they had hoped.

The 170 years of close association between the U. S. and Brazilian navies greatly influenced and aided Brazilian Naval development. When this support fluctuated due to changing political climates, Brazil's choices became limited: either remain the lesser partner of the United States, content with the fate of the Brazilian military in American hands, or strike out independently and strive for self-determination. Brazil took the only path truly available.

III. THE BRAZILIAN DEFENSE INDUSTRY

A. INTRODUCTION

Brazil's industrialization began in the 1930s and gained momentum after a period of slowed growth during WWII. The decade immediately after the war was an era of economic prosperity. [Pereira, 1984, pp. 20-22]

The military-industrial complex developed through careful design. With creative planning and perceptive foresight, the Brazilian government instituted policies that steered the fledgling arms industry toward improved manufacturing capabilities and receptive markets.

B. A SHORT HISTORY OF THE BRAZILIAN DEFENSE INDUSTRY AND RELATED GOVERNMENT POLICIES

> The growth of defense production in developing countries is obviously not a historical accident. Nor is it the product of national whimsy. It is, in short, a consequence of perceived national needs...The reality is that Third World decision-makers perceive an indigenous arms industry as providing at least a partial answer for meeting their national needs. [Moodie, 1979a, pp. 23-24]

In the early 1930s, the Brazilian government became closely involved in the process of industrialization. The world-wide depression had caused exports to decline and this caused the decline of foreign exchange resources. To protect local products from foreign competitors the government imposed tariffs, quotas, and exchange controls to make foreign goods very expensive. This allowed indigenous entrepreneurs to produce or increase production of good previously imported. Industrial production increased as a result. [Gwynne, 1986, p. 23]

The take-over of the Brazilian government by the military in 1964 allowed the new regime to emphasize its own priorities for the country. Economic growth through encouragement of foreign investors was accentuated. Convinced that Brazil was going to become a great and influential power that would need a better equipped armed force, the new authorities encouraged the development of the arms industry. By 1968, the country had entered what would later be termed the "economic miracle" and industrial modernization was in full swing. [Nyrop, ed., 1983, pp. 303-304]

By 1965 as Table 1 shows, a number of successful multinational corporations were established in Brazil. These industries provided the base for the modern arms industry, moving swiftly into the expanding and potentially profitable markets.

There were at least four automobile industries operating in 1965 and seven other companies which were probably indirectly involved in the manufacture of cars. Indeed in 1979, 25% of Brazil's exports were cars. By contrast, cargo ships and tankers composed 3.9% of Brazil's total exports. [World Bank, 1983, pp. 238-239]

The development of the arms industry was based on the collaboration of these transportation and machine industries, with initial products being wheeled vehicles for military use. Volkswagen automotive production technology was adapted to manufacture armored personnel carriers, military trucks, and light tanks. In the 1970s, Rolls-Royce do Brasil Limitada made the turboprop and turbojet engines for Brazil's new aircraft industry. [Evans, 1986, p. 105]

TABLE 1.

SELECTED FOREIGN FIRMS WITH MANUFACTURING FACILITIES IN BRAZIL--1965 [BUSINESS INTERNATIONAL CORPORATION, 1965, P. 50]

Armco Steel Corp.	United States
The Bendix Corp.	United States
Borg-Warner Corp.	United States
Caterpillar Tractor Co.	United States
Combustion Engineering Inc.	United States
The Electric Storage Battery Co.	United States
FMC Machinery Int'l	United States
Ford Motor Co.	United States
General Dynamics Corp.	United States
General Electric Co.	United States
General Motors Corp.	United States
General Telephone and Electronics Corp.	United States
Honeywell Inc.	United States
B. F. Goodrich Co.	United States
Ishikawajima-Harima Heavy Industries Co., Ltd.	Japan
Kaiser Industries Corp.	United States
Radio Corporation of America	United States
The Singer Company	United States
Standard Oil Company of California	United States
Timken Roler Bearing Co.	United States
U. S. Steel Corp.	United States
Vickers, Inc.	United States
Volkswagen A. G.	Germany
Westinghouse Electric Corp.	United States

Brazil has given the most explicit attention to the role of technology in economic development and to the stimulation of technological development through government policy. Before 1968, most of the effort on the creation of a technological infrastructure focused on institution building and human resource development. Beginning in 1968, scientific and technological

> development became a specific policy objective, articulated mainly by the National System of Scientific and Technological Development (SNDC) and the National Fund for Scientific and Technological Development (FNDT). The latter soon became the principal instrument for the implementation of science and technology policy. [World Bank, 1983, p. xiii]

Subsidized financing was used to encourage technological development. From 1964-1974, priority funding was dedicated to postgraduate training for scientists and engineers. After 1974, funding also targeted methods to increase firms technological activities. [World Bank, 1983, p. xiv]

After 1971, the government also concentrated on improving technology transfer. First it evaluated whether the technology should be imported. It sought to reduce the cost of the imported technology by strengthening the bargaining position of the local licensee and eliminating clauses restricting the local absorption and dissemination of the imported technology. It attempted to avoid limits in the export of products manufactured with the technology and favored the importation of technology rather than capital or goods. The technology transfer was concluded only if the recipient Brazilian companies could absorb and use the technology. Brazil demanded full disclosure of technical knowledge by the proprietors of the technology and required the recipient companies to present plans for the absorption of the technology and for local personnel training. [World Bank, 1983, pp. 99-100]

The government divided technology transfer agreements into five categories; 1) patent license agreements (title to industrial property, knowhow and technical assistance; 2) trademark license agreements (right to use trademarks that involve title to industrial property); 3) industrial technology license agreements (transfer of knowhow to manufacture consumer goods); 4) technological and industrial cooperation agreements (transfer of knowhow for manufacturing industrial plants, machinery, and equipment); and 5) technical service agreements (planning,

programming, and performing studies, projects, and specialized services). [World Bank, 1983, p. 100]

In 1975 the government-owned company Industria Material de Belico (IMBEL) was established. It reorganized the military industries to give them the dynamism of private industry and better coordination with the civilian industries. IMBEL also tackled areas too difficult for the private sector such as precision instruments. IMBEL preferred the installation of foreign factories in the country, and demanded the foreign companies find their own export markets and transfer the technology of the products they manufactured to Brazil. [Moodie, 1979a, p. 48]

Brazil's policy toward foreign investment has been one of the most open among developing countries. Brazil has relied on foreign investment as source of technology and a source of capital to carry out large investment programs and national development plans. The most common type of contract which Brazil entered into with foreign firms was technical assistance, followed by engineering services, trademark licenses, licenses for fabrication, and project preparation. [World Bank, 1983, p. 98-99]

In the high technology sectors, foreign capital is acceptable only if there is effective exchange of technology. The Brazilian agency in charge of technology transfer is the national Institute of Industrial Property (INPI). It regulates transfer of technology, establishes rules and policies for using patents, and decides whether the technology is useful to Brazil. Most technology transferred originates in the U. S., Japan, and the Netherlands. [IL&T, Brazil, 1987, pp. 3, 13]

Brazil has since maintained as protected a market as possible while stimulating industrial exports through tax rebates. In 1981 for example, this rebate was a 15% subsidy on export sales. [Gwynne, 1986, pp. 28-29]

Brazil sees many advantages to being less dependent on the United States, particularly in its arms industry. Besides minimizing dependence on America and other arms suppliers, Brazil desires to reduce military and political vulnerability in times of crisis. Attempts by trading partners to control or limit technology or arms transfer have been traditionally perceived as interference in Brazilian national sovereignty. Additionally, the economic incentives of increasing exports have become more attractive as the debt of the country continued to grow. [Moodie, 1979a, pp. 25-31]

According to Moodie [1979a, pp. 38-41], a country's defense needs are influenced by its military environment, the strategy and tactics it employs, and the technology available. Thus Brazil sought to meet its defense needs as well as its needs for continued industrial development by producing systems indigenously which would meet its military requirements, use and improve its existing technologies, and provide greater influence, economic advantages, and political independence.

However, the argument is also made, not the least by the Brazilian Armed Forces, that the quality of Brazil's arsenals and Brazil's future competitiveness in the arms market depend on access to American high technology. [SIPRI Yearbook, 1987, p. 199]

Brazil is better than most other Latin American countries at adapting and improving technology to meet local circumstances. Brazil has a large number of highly trained professional and technical people that produce an internal flow of technological knowledge. The availability of these people makes adapting the imported technology easier. As the Japanese model of industrialization has shown,

modern industrial success is rooted in constantly adapting and improving imported technology, first to local conditions and then for export. [Gwynne, 1986, p. 43]

Brazil's policies welcome new technological designs but vigorously promote domestic adaptation and improvement. The government also insists that multinationals export a substantial portion of their products, up to as much as two third in some cases. In return, Brazil adamantly excludes imports of competitive products from rival multinational companies. [Gwynne, 1986, p. 44]

The multinational firms have been instrumental in providing Brazil with foreign exchange, domestic income, and increasing labor and management skills. When combined with the other two partners in Brazil's industry, the state firms, and the national private firms, the process of industrial expansion became even more efficient. Research and development teams and investments, and the ability to adapt local products to meet the requirements of importing countries, made the export markets attractive to Brazil and encouraged additional adaptation and refinement of products. [Gwynne, 1986, pp. 44-52]

The high technology used in arms manufacture is probably spilling over into the civilian sector. Conversely, because of the great profits to be made and the government incentives offered, many foreign companies with plants in Brazil, such as Singer, General Electric and Honeywell, are moving into arms production. [Williams, 1984, p. 26]

C. TECHNOLOGY TRANSFER AND ACQUISITION

Technology transfer has been an ongoing process for thousands of years. Technology has been stolen by foreigners or carried out by migrants. It has been passed from parent to child, teacher to student, master craftsman to apprentice. With the advent of capitalism, technology itself became the object of commercial

transaction. Today it is a commodity with peculiar properties. [Monkiewicz and Maciejewicz, 1986, p. 1]

The strategic character of technology is not a recent revelation. The Norsemen, invading Europe in the early 1800s, quickly realized that the French made the best swords available and took great pleasure in using them to plunder their makers. Charlemagne, King of France from 771 to 814, took steps to prohibit the export of French-made swords to the Vikings, even imposing the death penalty on anyone found breaking this law. [Brondsted, 1967, pp. 120-121] However it is only recently that governments have realized how much technology transfer can truly change the balance of power between nation-states.

Technology can be acquired in a great many ways. It can be stolen through industrial espionage, passed through unclassified literature or trade shows, expressed through scientific exchange programs, or passed from one person to another through teaching or technical training. The export of technical data includes not only actual shipment or transmission of data out of a country but includes visual inspection by foreign nationals, and the application to situations abroad of personal knowledge or technical experience learned in the U.S. [National Academy of Sciences, 1987, p. 87]

The primary form of transfer this study will examine is the trade between countries through active military exports and license applications, military sales, and security assistance.

The concern surrounding transfer of technology arose in the early seventies. The first official study, the Bucy Report, commissioned by the Department of Defense in 1976, concluded that the primary emphasis in technology control should be the control of "design and manufacturing knowhow." [Bucy Report, 1976,

p. xiii] The study reported that the control of design and manufacturing knowledge pertaining to military equipment or weapons is vital to the security of the U. S. and its allies.

> National security depends upon the technology intensive industries both for sophisticated items essential to modern weapons superiority and for a strong and flexible industrial capability for future contingencies. [U.S. Department of Commerce, 1983, p. iii]

According to Bucy, there are three areas that should receive primary emphasis in control efforts. These are: design and manufacturing information that includes instructions for design and manufacturing processes; keystone manufacturing, inspection, or automatic test equipment; and products accompanied by sophisticated operation, application, or maintenance information. [Bucy Report, 1976, p. 3]

In addition to defining the areas to be protected, the Bucy Report also concluded that the manner in which information can be transmitted can effect the efficiency with which the information is absorbed and put to use by the receiver. Transfer of vital design and manufacturing know-how takes place most effectively with direct person-to-person interaction. [Bucy Report, 1976, p. 4]

In 1982 a panel of the National Academy of Sciences examined the effect of export controls on U. S. national security. Continued concern over the effects of these controls caused a second panel to convene in 1984. The panel made several recommendations, most of which are not directly related to this study. However, several suggestions were made regarding agreements with Free World countries that are not aligned with the United States or the Soviet Union:

- negotiate comprehensive understandings or informal arrangements that specify controls on the exports of specified goods and technology.
- clearly separate national security and foreign policy export controls.
- and balance the protection of military security with the promotion of the national economy. [National Academy of Sciences, 1987, pp. 169, 172-173]

These three recommendations have vital importance as they pertain to making the naval relationship between Brazil and the U. S. viable and operational.

D. STAGES IN TECHNOLOGY TRANSFER

Until recently, controlling military technology acquisition focused on transfers from the West to the Soviet Union or its satellites. It was feared that the transferred technology would allow the Soviets to vastly improve their military capabilities, allowing them to threaten U. S. and allied security.

Apprehension is now also directed at technology transfers to countries that are not alligned with the U. S., U. S. allies, or the U. S. S. R., countries that are willing to trade with anyone regardless of ideological differences.

Before addressing this area, an understanding of the mechanisms of transfer of technology will be helpful. The seven stages of knowledge acquisition which are outlined below [Louscher and Salomone, 1987b, pp. 4-7] suggest the learning process that takes place in the development of an indigenous arms industry.

Stage One is the acquisition of foreign manufactured items and foreign support and maintenance services. Through grant or security assistance, the nation obtains equipment from a country capable of manufacturing the items.

In *Stage Two* the receiving country becomes capable of maintaining the equipment. Repair and rebuilding knowledge is transferred either through related civilian facilities, or through training by the supplier. Often at this point, plants and facilities are built.

Stage Three is licensed assembly. Local production capabilities are expanded to include assembly under license. This production may take the form of unassembled kits or component packages. This stage includes the gathering and training of a major work force and labor specialization.

Licensed assembly differs from licensed production, coproduction, and indigenous production in several ways. First, the design of the item is still of foreign origin. Second, all the parts and components are still obtained from the foreign supplier. Finally, the design and construction knowledge and the organization of the work force are usually supplied by the foreign licenser. The critical transfer of production knowledge occurs at this stage.

By *Stage Four* the recipient nation has a capability to produce components and provide final assembly of the item.

In *Stage Five* the recipient nation develops an engineering ability to modify or copy the technology. This ability is then used to produce equipment that does not require license or coproduction agreements.

The ability to indigenously design weapons systems marks *Stage Six.* Reliance on foreign technology, training and parts is greatly diminished.

By *Stage Seven* a nation has achieved the ability to design and manufacture systems completely within its own domestic industries.

How well a nation is capable of adapting and using foreign technology to build up its own industries is dependent on a great many factors, not least among them the ability to finance a large volume of imports for a fairly long time. [Looney, 1987, p. 164] As will be seen, Brazil has sustained a large but useful flow of naval imports. However, Brazil has not been very successful in developing an indigenous naval industry and has established only a small, regional export market for naval products.

E. DEVELOPMENT OF A NAVAL INDUSTRY

> Warships are by far the most expensive classical weapons systems that exist. [Faltas, 1986, p. 39]

Military equipment and weapons are expensive, and the cost continues to rise. A major part of this expense is the increasing complexity of modern military systems. The addition of the computer plus the complicated electronic integrating systems may give advantages in capability to hardware, but may also quadruple the cost. Some estimates calculate that the replacement cost of one warship doubles every four years. [Faltas, 1986, p. 39]

According to Faltas [1986, pp. 54-55] there has been an internationalization of the demand for modern warships. Prior to World War II, there wasn't really a world market for navy ships. The few nations that had them were considered the great powers, and almost exclusively built their own navies. But after the war, the changes in alliances caused changes in naval missions and this implied changes in the fleets themselves. The overall effect was that most of the navies, particularly in Western Europe, became smaller. On the other hand, with their own markets declining, and with many Third World countries becoming more affluent and showing desires to behave as and assume the trappings of great powers, the opportunity arose for the European shipyards to sell their wares.

Of course not all naval vessels were available for sale. For example, nuclear powered submarines and large surface ships were not very marketable. These types of vessels were simply not available for transfer or were not a preferred product, being much too expensive to purchase and maintain and not very useful. But the other types of ships such as conventionally-powered submarines, destroyers, frigates, patrol craft and a variety of auxiliary vessels were very marketable and much more affordable. [Faltas, 1986, p. 61]

By the late 1970s, the number of countries importing warships and related technology had increased fourfold. It is not surprising that the nations obtaining

this technology were those without highly developed naval industries, including Brazil. [Faltas, 1986, p. 75]

The emergence of the modern naval industries in Brazil no doubt began with the ship-building industries already in place. Brazil, just prior to World War II, began to modernize its navy by building three destroyers based on U. S. designs. Brazil then negotiated several joint or coproduction agreements that provided needed upgrades to the navy and added vital naval technology and training to the industry. [Ferreira, 1983, p. 10]

Brazil's pursuit of naval skills and knowledge followed the acquision path described by Faltas. [1986, pp. 84-93] Brazil began by signing a contract with a foreign shipbuilder, agreeing to the first ship being built in the foreign yard. The next ships would be assembled and constructed in Brazil with the training and technical assistance provided by the contracting technicians.

There are other factors that have affected the acquisition of naval technology, and these played an important role in the Brazilian navy. Brazil received the largest portion of its naval ships from the U. S. These ships were from the World War II era and were purchased by Brazil. Since these were American ships, it was then necessary for Brazil to adopt American methods of operation. This led to a diffusion of naval doctrines and tactical concepts from the United States Navy to the Brazilian Navy as well as training and the technological expertise needed to maintain the equipment. [Ferreira, 1983, p. 23]

The Brazilian Navy began to modernize and contract with other countries for modern ships. The transfer of manufacturing technology became an important part of the contract agreement, and this further infused technology into the industry.

The Brazilians also became experienced and educated enough to design their own ships or to change the designs of the imported ships and have now moved closer to the goal of indigenous design and construction. [Faltas, 1986, pp. 87-93]

As active as Brazil's still young naval industry is, there remain several factors which will continue to obstruct further development. First, there is still not much demand for naval ships. As the economies of scale are extremely important in determining the cost of a product, unless Brazil can cultivate a market for ships outside her own navy, then the construction cost will remain relatively high.

Further, the type of ship and equipment Brazil may wish to build for its own navy may be unsuitable for the most likely clients. For example, Brazil wishes to build several more Niteroi Class frigates, however, her clients have primarily purchased smaller patrol craft and marine patrol aircraft suitable for their naval missions as listed in Table 2. Their requirements for frigates are extremely limited and are not likely to change in the near future.

Finally, some of the weapon systems Brazil is interested in involve sensitive technology that is unlikely to be released. [Faltas, 1986, pp. 133-135]

However, there is a growing market for equipment that can be used to upgrade the systems already in place in a country. This method of modernization is less expensive than buying new systems, and is expanding as noted by Louscher and Salomone. [1987a, pp. 131-160]

As with any commercialization process, marketing organizations and procedures must be established. To stimulate arms exports, countries and companies have patronized military periodicals and industrial journals to increase advertising bases, demonstrated equipment during exhibitions and overseas visits,

TABLE 2.

MAJOR IDENTIFIED NAVAL ARMS AGREEMENTS--BRAZIL EXPORTS 1970-1985

[LOUSCHER AND SALOMONE, 1987b, P. 96-98]

RECIPIENT	DATE ORDERED	WEAPON NAME	AMOUNT
El Salvador	1977	EMB-111 Maritime Patrol Aircraft	12
Chile	1977	EMB-111N Maritime Patrol Aircraft	6
Chile	1977	Anchova Class Fast Patrol Boat	10
Sudan	1979	EMB-111 Maritime Patrol Aircraft	6
Gabon	1980	EMB-111 Maritime Patrol Aircraft	1
Argentina	1982	EMB-111N Maritime Patrol Aircraft	3
Guyana	1982	EMB-111 Maritime Patrol Aircraft	2
Libya	1983	EMB-111N Maritime Patrol Aircraft	8
Paraguay[a]	1983	Roraima Class Patrol Craft	1
Honduras[b]	1983	EMB-111 Maritime Patrol Aircraft (unconfirmed)	
Portugal	1983	EMB-111 Maritime Patrol Aircraft	5
Peru[c]	1986	EMB-111 Maritime Patrol Aircraft (unconfirmed)	3
Libya[c]	1987	EMB-111 Maritime Patrol Aircraft (negotiating)	8

[a]SIPRI 1986, p. 394
[b]SIPRI 1985, p. 397
[c]SIPRI 1987, p. 255

and cultivated diplomatic support in all ranks of government. [Faltas, 1986, pp. 194-198] Brazil has also been adept at marketing, as illustrated by volume of sales and the reputation of willingness to bargain.

Brazil has also been most successful in encouraging foreign investment. For example, West Germany's M. T. U. Friedrichshafen, a company which supplies diesel engines for conventional submarines and surface ships, set up a subsidiary in Brazil in 1978 to provide marketing assistance to the parent company, perform maintenance for the clients in the region, and to develop its own capability for serving the national and regional markets. [Faltas, 1986, p. 272]

F. THE TREND IN NAVAL EXPORT AGREEMENTS

In Brazil, from 1964 to the present, the growing and continued emphasis on technology acquisition in the place of completed weapons systems is very apparent. As can be seen from Table 3, the naval production capability of Brazil depends on technology and assistance acquired from other countries. Though Brazil placed enormous emphasis on developing indigenous industries, it concentrated on developing its aircraft and armored vehicle industries, and deferred development of the naval industry. [Louscher and Salomone, 1987a, p. 109]

Of ninety-eight military export agreements reported by Louscher and Salomone [1987a, p. 118-119], only seven are navy related. Of those seven, none are totally indigenous. By contrast, of the remaining two industries, aircraft and armored vehicles, 18 of the exports agreements or 19.8% are made entirely in Brazil. These numbers are additional indicators that the naval industry is not a priority for the Brazilian government.

TABLE 3
LICENSED PRODUCTION OF MAJOR NAVAL WEAPONS--BRAZIL
[LOUSCHER AND SALOMONE, 1987b, P. 92]

COUNTRY	WEAPON NAME	LIC. YEAR	PROD. YEAR
United Kingdom	Niteroi Class Frigate	1972	1972-75
France[a]	HB-350M Esquilo Helicopters	1977	1981-87
Italy[b]	Sauro Class Submarine	1980	Unconfirmed
	Wadi Class Corvette	1980	Unconfirmed
France[b]	Agreement signed by the French and Brazilian Defense Ministers calling for the transfer of French shipbuilding technology to Brazilian shipyards. (Exact date not noted.)		
FR Germany	Type 209 Submarine	1982	1985

[a]SIPRI 1986, p. 413
[b]SIPRI 1983, pp. 309, 345, 489

Brazil's Army and Air Force exports began to have a large impact on regional military relationships and power structures and on the world's market. The fact that Brazil now successfully exports these products indicates that they are acceptable in both quality and quantity, that Brazil can produce them at a reasonable price, and that other nations have found these products preferable and worth purchasing. [Louscher and Salomone, 1987a, p. 113]

But what are some of the factors that accelerated the development of the army and air force equipment and caused the navy to lag behind? First, there is the perceived lack of a market for naval equipment. During the early 1960s, a group of the arms industries conducted a market feasibility study for their weapons products in Latin America, Africa, the Middle East, and the Persian Gulf. Using

the findings, the Brazilian firms targeted their production at exports of simple, cheap, and reliable systems--transport planes, the armored personnel carrier and tanks--for use primarily in the Persian Gulf and Latin America. [Evans, 1986, p. 105] Industry planners emphasized the use of the country's resources for foreign exchange to service Brazil's debts. Most of Brazil's clients are land-locked and are involved in conflicts in which naval equipment is not needed. In 1965 the areas of major conflict were primarily the same as they are today, with the conflicts concentrated in desert and mountainous terrain. There was no market in 1965 for naval ships or equipment, and the market has not grown measurably since then. The few naval exports that Brazil has reflect the same need for coastal boats, river patrol boats or maritime patrol aircraft that Brazil itself finds useful. The countries that import Brazilian patrol craft or maritime patrol aircraft do not show an inclination to develop large navy. In fact, as Table 4 illustrates, the amount of indigenous naval construction has declined.

Second, the industries already in place were more adaptable to personnel carriers than warships. As previously indicated, the auto industry was firmly established in Brazil with manufacturing, resources, and skilled labor already in place.

Finally, the technology for building naval ships is more complex than that used in building the basic army equipment. Though Brazil excels at building merchant ships, it has not mastered the diverse and complex technologies that comprise electronic equipment used in modern warships. Table 5 shows that most of the weapons systems that are placed on the Brazilian ships are purchased from abroad, indicating that Brazil is still struggling to absorb many technologies. Besides being more complex, this type of naval technology is more expensive. A modern tank

may cost $1.8 million, a fighter aircraft $18 million, but a frigate may cost $180 million or more. [Ferreira 1983, p. 32-39] Resources are still scarce and the investment is probably not there because there would be no return.

National planning directed that arms producers not overlap in production and thus not compete with each other for markets. [Nyrop, ed., 1983, p. 306] This fact becomes more interesting when the statistics for the licensed production of weapons systems is examined. Of 23 production agreements listed by Louscher and Salomone [1987b, p. 92], only two are navy related. The remaining 21 agreements deal with army and air force systems. Since the military must purchase the majority of the electronic systems from other countries, this implies that the industries have not developed the capabilities for producing complex electronic

TABLE 4.

PERCENT OF BRAZILIAN NAVAL CONSTRUCTION 1965-1985

[PANDOLFE, 1987, PP. 339, 383, 426]

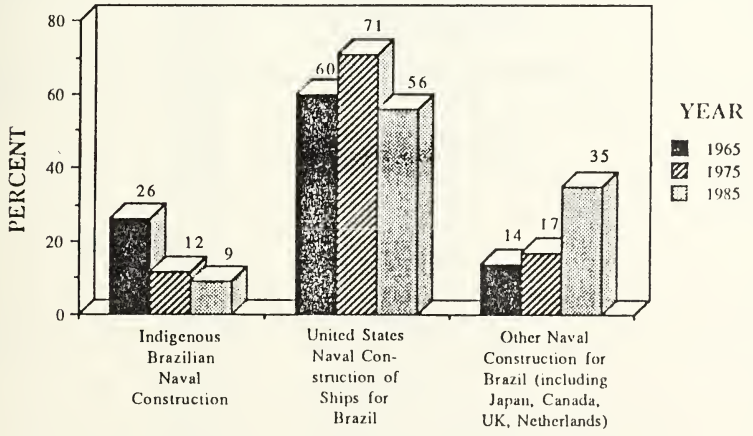


TABLE 5.

BRAZIL--MAJOR IDENTIFIED NAVAL ARMS AGREEMENTS/IMPORTS

1970-1985

[LOUSCHER AND SALOMONE, 1987b, PP. 88-89]

SUPPLIER	DATE ORDERED	WEAPONS NAME/DESCRIPTION	QTY
Australia	1972	Ikara-3 ShShM	144
	1972	Ikara ShSuM	26
	[a]1983	A-4G SkyHawk Fighter-Bomber (for Navy)	12
France	1970	MM-38 Exocet ShShM	24
	1972	Otomat ShShM	Unk
	1972	MM-38 Exocet SSM	20
	1982	MM-40 Exocet ShShM/SShM	48
	1983	Exocet SSM	12
	[b]1984	MM-40L ShShM Launcher	8
	[a]1984	MM-40 Exocet ShShM/SShM	48
	[b]1984	MM-40 Exocet	24
	[b]1985	AM-39 Exocet	24
	[b]1985	AS-350 Ecureuil Helicopter	11
	[b]1985	AS-332 Helicopter	6
FR Germany	1983	Aratu Class Sweep	2
	1982	Type 209 Sub	2
Italy	1980	Wasi Class Corvette	12
	1980	Maestrale Class Frigate	Unk
	1980	Sauro Class Sub	9
	[a]1982	SH-3D Sea King Helicopter	6
UK	1969	Oberon Class Sub	2
	1970	Vosper Mk2 Niteroi Class Frigate	2
	1972	Seacat ShShM/ShAM	104
	1974	Sea King ASW Helo	3
	1975	WG-13 LLynx ASW Helo	9
	1975	Sea Skua AShM	Unk
	1977	Wasp ASW Helo	3
	1979	Wasp ASW Helo	4
	1981	Wasp ASW Helo	1
	1982	Tigerfish Mk24 Torpedo	60
	[b]1985	Sea Skua AShM	32
US	1973	Allen M Sumner Class Destroyer	1
	1974	Guppy II Type Sub	1
	1974	Torpedo Boat	8
	1983	LVTP-7A1 Amphibious Assault Craft	16
	[b]1985	Model 206B Helicopter	16
	[c]1985	LVTP-7A1 Amphibious Assault Craft	12

[a]SIPRI 1985, p. 391

[b]SIPRI 1987, pp. 240-41

[c]SIPRI 1986, p. 375

components that could be used to make systems for any of the service branches. If the navy had been the primary recipient of systems purchased outside the country, then the assumption could have been made that the other branches had developed the technology but were not using it to arm the navy. The lack of capability in all areas also accounts for Brazil's interest in protecting and developing its computer industry and developing the capability to produce the electronic systems.

G. SUMMARY

In Chapter II the concern with technology transfer is examined, and the stages a company, or on a grander scale, a country, goes through when absorbing technology were outlined. The overview of Brazil's government policies illustrated how they complemented and encouraged the expansion of the arms industry. The stress on licensing, coproduction and technology transfer and acquisition, and the use of multinational industries already in place, fostered a climate that, in the short span of 23 years, took Brazil from an underdeveloped country, to a newly industrializing nation, feverishly competing in international arms trade.

The decline of indigenous naval production may be due to any number of reasons. Perhaps the small buyers market, which is mostly regional, is saturated. The recipient countries do not have a need for large amounts of such equipment. Or maybe the resources which would be normally used to produce the naval equipment are being used elsewhere, in the merchant ship industry. The army or air force industries may have diverted the materials for their own use. Finally, the small amount of coastal ships that even Brazil needs may have made production too expensive for the time being. It would be more economical to wait for additional orders, combine them, and then produce the required systems.

However, a marked difference is obvious when comparing the Navy, Army and Air Force industries. The army and air force equipment tend to have higher priority in the Third World. [Faltas, 1986, p. 287] This prioritization holds true in Brazil. With the markets directing the merchandise, the technology being complicated, and the successful arms exports influencing the pattern of national defense procurement, the explanation for the slow development of the navy begins to emerge.

IV. THE U.S./BRAZIL RELATIONSHIP

A. INTRODUCTION

The United States has traditionally transferred arms that met valid military requirements and garnered political influence and leverage for the United States. Criteria normally used to assess the validity of the military requests have generally been the responsibility of the Defense Department. The State Department recommends actions forwarding U. S. interests. [Ronfeldt and Sereseres, 1979, p. 169]

It is increasingly difficult for America to define valid military requirements, particularly when dealing with nations that are determined to emphasize their own perceived needs. When dealing with two or more countries, complications can arise. If the U. S. desires to maintain close relations with all parties, the options can be limited and can adversely influence relations. If military equipment being requested does not appear justifiable in terms of both the threat and the local capabilities for absorption or operations, the U. S. may simply not respond to the request. [Ronfeldt and Sereseres, 1979, pp. 169-170] Now, the U. S. must look beyond its own perceptions of "valid" To retain political influence with Brazil, America must now accept Brazil's priorities and desires for a more equal naval partnership. This partnership should include naval technology and security assistance.

> The U. S. Government has tended to expect arms transfers to return benefits in the form of political influence and leverage. Indeed, arms transfers are an important element within the web of relations, and may serve to create dependencies and interdependencies. Certainly arms transfer programs can contribute to a climate of political goodwill and can provide

access to influential military and political elites. In addition, during a moment of crisis the dependence on U. S. logistics and resupply may be manipulated for short-term gains... [Ronfeldt and Sereseres, 1979, p. 172]

Beginning in the early 1960s, America noticed that many developing countries were progressing toward assuming a greater financial share of their defense. Additionally, profits from arms sales contributed positively to the U. S. balance-of-payments and the arms industry. Thus arms sales were given more emphasis and arms assistance was advocated less. [Warnke and Luck,1979, p. 195]

B. ARMS TRANSFER PROCEDURES

Arms Transfer procedures are governed by the 1976 Arms Export Control Act. When the U. S. transfers technology it considers critical to a recipient country, that country must get permission from the U. S. before it can transfer the technology to a third party. Brazil has preferred to avoid such restrictions and tried to limits its requests to components not under such strict control.

In 1976 The International Security Assistance and Arms Export Control Act expanded Congress's oversight by requiring all non-NATO military sales of $25 million or more be handled through government-to-government (FMS) sales rather than commercial channels. These sales became subject to congressional veto. The act also required the President to submit to Congress a yearly country-by-country justification, including an arms control impact statement. The third change made by the act expanded the reporting procedures on both commercial and government military exports, requiring information on agents fees and political contributions. [Warnke and Luck, 1979, pp. 215-216]

The formal decision-making process for Foreign Military Sales (FMS) is initiated when a foreign government makes a request through either diplomatic or military channels. The request is referred to the Bureau of Politico-Military

Affairs and the regional bureau in the State Department. The Naval Office of Technology Transfer and Security Assistance reviews navy-related requests and consults with other agencies as appropriate. Routine sales are handled at lower levels. Major decisions involving policy are made at higher levels, sometimes requiring Presidential decisions. Upon executive branch approval, a Letter of Offer outlining the terms is prepared. If the sales exceed $25 million the sale must be approved by Congress. It is then presented to the foreign government. If the offer is accepted the appropriate branch of the service carries out the terms of the offer. [Warnke and Luck, 1979, pp. 216-217]

Commercial sales may be initiated through promotional efforts of private arms manufacturers. These sales undergo a similar review process. Sales not subject to congressional approval then proceed through private rather than Defense Department channels. [Warnke and Luck, 1979, p. 217]

C. TECHNOLOGY TRANSFER CONTROL PROGRAM

> The Technology Transfer Control Program is the management mechanism by which the Department of Defense (DOD) discharges its responsibility for participation in the regulation of military-related exports of goods, services, munitions, and technology under the Export Administration Act of 19797 and the Arms Export Control Act. [Weinberger, 1984, p. 9]

This program was initiated in 1981 in response to congressional concern for protection of America's key technologies and military systems. It gave the Under Secretary of Defense for Policy the responsibility for coordinating DOD policy on technology transfer. The Under Secretary of Defense for Research and Engineering manages the overall technical efforts of DOD. Major areas of concerted effort include:

- improving interagency and international cooperation,

- engaging experts from industry and academia to assist in identifying militarily critical technology,
- recommending export control procedures, and
- informing U. S. industry, academia and the public of the impact of technology transfer on the East-West operational military balance. [Weinberger, 1984, p. 9]

Department of Defense (DOD) Directive 2040.2, "International Transfer of Technology, Goods, Services, and Munitions" established the International Technology Transfer Panel, and formed the Technology Security Center (effective 1984). The Transfer Panel assists DOD in resolving internal differences of opinion over policy and technical recommendations on technology transfer. [Weinberger, 1984, p. 9]

This Directive states that the Department of Defense will treat defense related technology as a valuable limited national security resource and sets forth the following guidelines:

- to manage transfer in a way consistent with U. S. foreign policy and national security objectives,
- control exports that would contribute to the military potential of a country dangerous to U. S. security,
- limit transfer of advanced design and manufacturing knowhow to those transfers supporting specific national security or foreign policy objectives,
- facilitate the sharing of military technology only with allies or other countries that also safeguard that technology,
- give special attention to rapidly emerging and changing technologies to keep them from the wrong hands,
- strengthen foreign procedures for protecting sensitive, defense-related technology, and
- ensure reciprocity in sharing defense-related technology [Weinberger, 1984, pp. 31-32]

D. U. S. SECURITY ASSISTANCE POLICY IN LATIN AMERICA

United States policy in the Western Hemisphere, as stated in the FY 88 Annual Report to the Congress, is to deter strategic attack on North America, promote democracy and freedom, foster economic development, and maintain the security of the region. In Latin America, the U. S. has traditionally maintained a limited military presence, and programs are planned according to the Rio Treaty and the Charter of the Organization of American States. Economic and military assistance have been the primary methods pursued in obtaining security objectives. Thus, the strategy has been to increase foreign assistance, promote regional self-defense capabilities, and actively participate in exercises and training as a show of support. Recently, however, funding has been reduced in foreign assistance and defense resources have been cut. [Weinberger, 1988, pp. 266-268]

The United States desires to protect fundamental national interests without resorting to armed conflict. The Security Assistance Program defines these interests as territorial integrity, political and personal freedoms, democratic institutions, and economic prosperity. The U. S. government feels that U. S. security and well being are best protected by the orderly conduct of relations among nations, broad acceptance of democratic values, and a better quality of life for all people. [Congressional Presentation for Security Assistance Programs, Vol. 1, 1987, p. 9]

> To assure our own and the free world's security, and to avoid war, the United States seeks first to deter aggression and--should this effort fail--to ensure that we and other nations can mount an adequate defense to frustrate aggressive designs. [Congressional Presentation for Security Assistance Programs, Vol. 1, 1987, p. 9]

Immediate security objectives include:

- improve relations with all nations, especially those in strategic areas of the world,
- strengthen and develop defensive alliances and other cooperative military arrangements,
- safeguard access abroad to support movement of U. S. forces to protect free world interests.
- enable countries to defend themselves against external threat, maintain internal order, strengthen democratic institutions and judicial systems, and
- alleviate the causes of economic and political disruption that threaten security and independence. [Congressional Presentation for Security Assistance Programs, Vol. 1, 1987, p. 9]

The immediate threats as defined by the Security Assistance Program are:

- expansionist and destabilizing behavior of the Soviet Union,
- indigenous regional tensions,
- political violence, terrorism, and insurgency, and
- basic political, economic, and social problems, including poverty, overpopulation, and corrupt governments. [Congressional Presentation for Security Assistance Programs, Vol. 1, 1987, p. 9]

The United States Security Assistance Program is an important instrument for pursuing peace and world order. It has been a cornerstone of postwar U. S. foreign policy, and an integral part of our overall national security effort. In order to maintain a stable world order, it is essential that threatened allied or friendly countries are able to defend themselves. [Congressional Presentation for Security Assistance Programs, Vol. 1, 1987, pp. 11-12]

Though America cannot provide all the equipment needed to secure a friendly nation, nevertheless, security assistance is a vital and necessary element in helping friendly nations build their own defense. Additionally, these programs play an important role in the global defense posture of the U. S. [Congressional Presentation for Security Assistance Programs, Vol. 1, 1987, p. 12]

The 1987 Security Assistance Program's policy goals towards Brazil are:

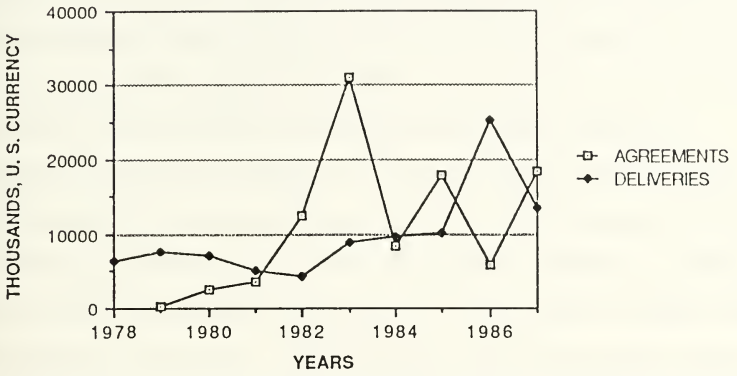
- promote key interests through FMS cash/commercial sales,
- enhance cooperative defense arrangements,

- advance military industrial cooperation,
- promote regional stability, and
- safeguard democratic institutions. [Congressional Presentation for Security Assistance Programs, Vol. 2, 1987, p. 149]

The Program's goal is to assist Brazilian forces in modernization efforts through system upgrades, reinforce positive military participation in civilian government, expand contact between U. S. and Brazilian military personnel, and increase U. S.-Brazilian military compatibility in tactics, training, and doctrine. [Congressional Presentation for Security Assistance Programs, Vol. 2, 1987, p. 149]

Under the 1987 program, Brazil is expected to continue to procure defense equipment and services, and professional and technical training through the Foreign Military Sales (FMS) cash and commercial procedures as in the past . As Table 6 shows, Brazil has used the FMS program extensively. The International Military and Education and Training Program (IMET), though modest at only $100,000, will provide formal training in the U. S. for Brazilian Armed Forces personnel in professional and technical courses. This training will improve compatibility between the U. S. and Brazilian armed services but the absence of even a modest security assistance program greatly hampers efforts to improve cooperation. [Congressional Presentation for Security Assistance Programs, Vol. 1, pp. 6, 52, Vol. 2, p. 149, 1987]

TABLE 6. U.S. DEPARTMENT OF DEFENSE DATA ON U.S. MILITARY SALES AGREEMENTS AND DELIVERIES TO BRAZIL[a] 1950-1987



[a] Foreign Military Sales, Foreign Military Construction Sales, and Military Assistance Facts, Defense Security Assistance Agency (DSAA) (Washington, DC: Data Management Division, Comptroller, 1987), pp. 6-7, 16-17.

E. THE DECLINE OF UNITED STATES/BRAZIL RELATIONS

The U. S. Navy has enjoyed a long and mutually beneficial liaison with the Brazilian Navy. From the time of the Spanish-American War the two navies have cooperated actively with each other and gained experience and respect. The establishment of the first U. S. Naval Mission in Brazil in 1922 heralded the beginning of close navy-to-navy dealings to include the transfer of technology from America to Brazil.

In 1942, as Brazil sided with the Allied Powers against the Axis, President of Brazil, Geulio Vargas, in 1942, placed the Brazilian Air Force and Navy under operational control of the U. S. Fourth Fleet. Their primary task was escorting the cargo vessels carrying previous supplies and protecting them from the German

U-boat threat. The joint efforts of the Brazilian and U. S. Navies resulted in the sinking of eleven German subs and the capture or destruction of five Axis blockade runners.

After World War II, the United States Navy gave Brazil 25 navy warships and 25 Anti-Submarine Warfare (ASW) aircraft, virtually all of which are still in service in the Brazilian armed forces today. Additionally the navy provided essential naval training and there was significant senior officer interaction.

The rise of Brazilian nationalism in the early seventies combined with the unsettled state of America, due to Vietnam and other internal concerns, altered the U. S./Brazil government-to-government relationship. Though the militaries maintained close and amicable relations, the U. S. and Brazil, as nation-states, found themselves drifting apart. Trade, technology transfer, debt issues, liberation theology and other subjects proved increasingly divisive. The focus of U. S. foreign policy was aimed at the Far East, China, and the Soviet Union, leaving little time for southern neighbors. America was perceived as being much too patronizing toward Brazil. In turn, the United States ushered in a peculiar form of 'benign neglect' of its long-time friend.

Another challenge surfaced in Brazil in the early 1970s. Brazil realized it had a massive energy problem that could not be resolved solely by building hydroelectric power plants. Needing a reliable source of power to continue industrialization and provide community services, the Brazilian government turned to nuclear power as a viable option. In the early seventies, the U. S. government offered technical assistance in the design and construction of the plants, but later declined to sell fissionable fuel to Brazil. Brazil then turned to the West Germans for reactor fuel. Shortly after his inauguration, President Carter sent

Vice President Mondale to persuade the Germans not to sell the required material to Brazil. This opposition by the U. S. government violated assurances made by Henry Kissinger to the Brazilian government in 1976. Kissinger had stated that the U. S. would not conduct any negotiations that would impact on Brazil without consulting the Brazilians first. Brazil's discovery of U. S. interference caused an immediate chill in the two country's relations.

In 1977, the U. S. Congress further eroded the American/Brazilian relationship by requesting Brazil submit to human rights reporting requirements. Though Amnesty International had reported favorably on the Brazilian situation in 1976, the Brazilians considered the Carter Doctrine an intrusion into their internal affairs and refused to comply with its provisions. The U. S. Ambassador to Brazil was tasked to deliver a demarche to the Brazilians encouraging them to acquiesce to the human rights reporting requirement. Both the timing and the tone of this message were inappropriate and the Brazilians reacted rapidly and rashly to this turn of events. The next day the Brazilian government renounced all military agreements with the United States.

The abrogation of these agreements had some very negative effects. In August of 1977, the Joint Brazilian United States Military Commission (JBUSMC) was terminated and in December, 1977, the U. S. Naval Mission in Brazil was also closed. In effect the Brazilian reuninciation of the 1952 and 1956 Military Accords cut off the blanket access the U. S. had enjoyed to Brazilian airports and seaports. Future use of these facilities would now require prior Brazilian approval.

This shift in the U. S.-Brazilian military relationship also affected military training. Brazil began to send more of its officers to Europe for education. Additionally other non-military areas were adversely affected. For example, the

Brazilian version of the FBI had been attempting to obtain computerized fingerprinting technology. This transfer of equipment was also stopped due to human rights sanctions.

To manage the security agreements that were already in progress and thus allowed to continue, the U. S. government created the Security Assistance Management Staff (SAMS). The Brazilian government was not wholly receptive to the establishment of this organization since it was perceived as an extension of JBUSMC and doubts existed as to the real purpose of SAMS. By 1980, the U. S. was able to convince Brazil to allow SAMS to remain, with negotiations for maintaining this presence coming up every two years.

SAMS, since renamed the Military Liaison Office (MLO), was and is still not officially allowed direct contact with their Brazilian military counterparts. For any request to be handled, the MLO must go through the Defense Attaché Office (DAO) which can then pass the information to the appropriate Brazilian military. The procedure is also reversed. For the Brazilian military to make a request, it must be made through the attaché, then be passed to the MLO for action.

By early 1986, the Brazilian Army had considerably lessened their restrictions and initiated some direct contact with the MLO. To a lesser degree the Brazilian Air Force had followed suit. However, several incidents have tarnished the navy-to-navy relationship. Thus while the Brazilian Army and Air Force have circumvented rigid regulations concerning contact, the Navy still avoids informal liaison. The Brazilian Navy thus sometimes makes requests to its attaché in Washington, thereby completely bypassing the in-country American assets.

F. GSOMIA

The General Security of Military Information Agreement, GSOMIA, is the bilateral government-to-government agreement which protects military technology transferred from the United States to the signatory country. GSOMIA receives its mandate from the 1976 Arms Export Control Act and requires that all classified military information passed between two governments and subsequently released to contractors must be protected in accordance with the following principles:

- the recipient country must not release the information to a third party without the approval of the releasing government,
- the recipient country will afford the same degree of protection to the military information as the releasing government afforded it,
- the receiver will not use the information for purposes other than the reason it was transferred,
- the receiver will respect all private rights such as patents and trade secrets of the releasing country,

Presently more than forty countries, including the NATO allies have signed security agreements. [GSOMIA, 1987, p. 1]

Brazil, however, has chosen thus far not to sign a GSOMIA with the United States. When first informed about the agreement, Brazil protested for several reasons. First, Brazil thought that the NATO Allies had not signed and that Brazil was being singled out in being required to sign the agreement before it could receive sensitive military technology. Second, Brazil misinterpreted the second requirement. Before the United States would allow any information to be released, it would need to inspect the security control systems of the receiving country. The Brazilian government interpreted this to mean that the U. S. would actually be inspecting the contents of its classified material containers and investigating other

secure areas. However, the U. S. only inspects the security methodology and even invites the other nation to examine or evaluate U. S. security systems and classified safeguards as illustrative of the requisite GSOMIA security standards.

According to a Navy spokesman, in 1985, Brazil was briefed on the GSOMIA. The U. S. proposed that Brazil sign the agreement to facilitate technology transfer requests that Brazil had made previously. However, Brazil was very reactive to this suggestion, believing they were being treated differently than other U. S. allies and so did not sign the agreement.

In February, 1986, the Under Secretary of Defense for Policy, Dr. Fred Iklé went to Brazil on a fact-finding trip. He had no set agenda but he did want to talk about GSOMIA. He felt that if the Brazilian government understood the agreement they would be willing to sign.

It was at this time that Secretary of Defense Weinberger decided to make an exception for Brazil. Instead of requiring that the GSOMIA be a government-to-government agreement, Secretary Weinberger offered Brazil the opportunity for service-to-service agreements. This offer was quite exceptional. Service-to-service agreements would require a separate agreement on a case by case basis. For every piece of equipment or technology requested, a separate agreement would have to be signed. Secretary Weinberger based his decision on Brazil's importance as an ally and defense partner. Brazil, however, remained adamant against signing a GSOMIA.

In July, 1986, Mr. Ambrose, the Assistant Secretary of the Army, made a trip to Brazil. He was tasked with discussing GSOMIA with the government and offered to send a team of experts to visit Brazil to discuss the agreement in detail.

In October, 1986, at the Seventh Annual Joint U. S./Brazil Security Consultations, GSOMIA was not on the agenda and therefore the U. S. did not expect the Brazilians to raise the issue.. However, during a question and answer period, Brazil asked the U. S. specifically to explain GSOMIA. The agreement again became a topic for discussion.

In November, 1986, the team of experts offered by Mr. Ambrose visited Brazil and explained the agreement. The Brazilian government still declined to officially sign, but the Brazilian Army, Navy and the Air Force independently expressed the desire to conclude service-to-service, case-by-case agreements.

At the Bilateral Maritime Strategy Talks held June 27 to July 2, 1987, the Brazilian Navy again requested information on GSOMIA. Realizing the need to sign an agreement before desired naval technology could be transferred, a Brazilian naval representative unofficially indicated a willingness to abide by the terms specified in the agreement.

Several significant events have affected the United States' attempts to encourage Brazil to ratify the GSOMIA.

The first event occurred in the early 1980s. The Brazilian Air Force requested information from the U. S. Air Force on rocket motors. This request was originally denied. Later, the Brazilian Navy made a similar request from the U. S. Navy. Because it had been previously denied, the request was reviewed by the Defense Policy Review Committee (DPRC) and again denied. This Navy review and this process took time. The Brazilian Navy was concerned that the delay in making the decision reflected inadequate consideration of the long-standing ties between countries.

The second significant event was a 1985 request from the Brazilian Navy for inertial navigations systems aboard submarines. The United States Navy reviewed the request and approved it. It was then also reviewed and approved by the Secretary of Defense. In 1986, before the systems could be delivered, the Brazilian Navy sent in another request for two additional systems of greater accuracy. The United States Navy denied the second request because they felt that the Brazilian submarine forces did not need the additional accuracy for navigation purposes and secondly there was concern about potential use of the technology for other applications. Though the U. S. Navy felt the Brazilians would not attempt to adapt the technology for other uses, U. S. government concern for unauthorized application decided the issue against transfer.

The third event was the November 1985 request from Brazil to lease or purchase several of the Charles F. Adams class DDG ships, on the U. S. Navy's active duty list at the time. Brazil's request was founded on the fact that their own corvette ship-building programs were significantly behind and the operational forces spent an inordinate amount of time in maintenance and upkeep of their World War II vintage ships. Although the U. S. Navy was receptive to this request, the need for a Congressional waiver to remove these ships from the active U. S. inventory is a politically sensitive action unlikely to garner support from the Secretary of the Navy in his pursuit of a 600-ship navy.

The latest request from the Brazilian Navy is directed at the possible opportunity for future purchase of six of the Garcia class or the Brooke class frigates, and one of the Thomaston class (LSD) ships. This petition, made in March, 1988, recognizes the requirement that the U. S. Navy must take these ships

out of active inventory before they can be offered up for possible sale. These requirements are under consideration at present.

There is support for the sale of these naval assets to Brazil. In December 1986, Admiral Trost directed that a South Atlantic Maritime Strategy be developed and incorporated into the U. S. global maritime strategy with specific roles designed for participating Latin American countries. He also directed that the countries involved should not be subordinate to United States policy but should work in support of each other, where and when appropriate, against a common threat. This assertion directly supports the goals of the U. S. Security Assistance Program mentioned earlier.

This initiative and the chance to supply these assets to Brazil provide the foundation for increased cooperation. As previously outlined, the United States and Brazil have had a long and mutually beneficial relationship. They have been hemispheric defense partners in the past and should continue to be partners in the future. Brazil is the primary political power in Latin America and as such can be very influential. America, by already signing a Memo of Understanding in 1984, has made an honest attempt to develop defense technology that is of mutual benefit to both countries. Should Brazil agree to sign the GSOMIA, past trends of could be reversed, and the navy-to-navy relationship could be considerably enhanced.

> It is inescapable but to conclude that Brazil's government and its navy are embarked upon a more independent (and nationalistic) foreign policy which conceptualizes new strategic realities and priorities. It would be wrong to perceive this inevitable decline in the relationship as inimical to western or U. S. interests. Instead, it would be far better to manage the diminution as best we can and seek to exploit opportunities of mutual benefit. [McCune, 1985, p. 3]

G. SUMMARY

This chapter has very briefly outlined arms transfer and security assistance procedures. The technology transfer dilemma between Brazil and United States Navy has yet to be resolved. Though the U. S. has offered to transfer certain naval technologies, Brazil's reluctant to sign the GSOMIA and protect the technology has prevented the resolution of any agreement.

Brazil's desire to purchase U. S. equipment indicates a preference for U. S. equipment and technology. The protection of this naval technology, though important, should not prevent the United States from supporting the Brazilian Navy.

> In this regard, efforts by the United States Navy to retain a strong allied posture with the Brazilian Navy have an importance which transcends both traditional service-to-service dealings and the defense dimension. Indeed, this relationship might well be termed a fulcrum for foreign policy and shared strategic interests in the South Atlantic for the governments of Brazil and the United States. [McCune, 1985, p. 2]

V. THE U.S. AND BRAZIL--FUTURE NAVAL PARTNERS

A. CONCLUSIONS

When undertaking this study, the conjecture was that Brazil has a successful naval industry and is actively exporting naval equipment. Additionally, United States security assistance and military technology transfer was thought to be a major contributor to the Brazilian naval industry. Preliminary research revealed that the Brazilian naval industry is not as active an arms exporter as its counterparts for several important reasons.

First, Brazil became dependent on foreign naval experience and equipment as early as 1822. The decline of the navy in 1870 forced the Brazilian Navy to import the majority of their naval hardware. For over 150 years, for a variety of reasons, Brazil has counted on the foreign market to supply its warships, and provide training and naval equipment. This dependence had been a burden. Brazil's priorities have often been set aside at a political and industrial diminution of her naval power.

This assistance has not only been from the United States. Recently, the Brazilians have turned again to Europe for military assistance and naval technology. Additionally, military officers have received education in European schools and learned European strategy and tactics. Though improvement in the capabilities of the naval industry has not occurred until very recently, the continued and increasing influence of European technology may cause naval cooperation between the U. S. and Brazil to further deteriorate. As the U. S. now seeks to

include Brazil in the Maritime Strategy, renewed naval interaction would better serve U. S. and Brazilian interests.

Brazil remains dependent on technology and training from other countries, such as France, the Federal Republic of Germany, and Italy. Brazil has also purchased items from Australia, Canada and the Republic of Korea. [Louscher and Salomone, 1987b, p. 89]

Vosper Thornycroft of England is still greatly influential in the Brazilian naval industry. Using Thornycroft designs, Brazil began production of coastal patrol craft in the 1970s. In 1972, Arsenal de Marinha began production of the Niteroi Class training ships, again basing their work on designs by Thornycroft. The first Brazilian designed frigate, completed in 1983, was constructed with advice from the West German Marine Technik Design Company. The engines for these vessels are of German or British origin and the missiles, guns, radar, and antisubmarine weapons continue to be purchased abroad. [Louscher and Salomone, 1987b, p. 92]

Secondly, during the "economic miracle" in the late 1960s, the Brazilian government stressed license agreements and technology transfer and acquisition when dealing with the multinational corporations that wanted to invest in the country. However, a market survey showed little opportunity for profit in naval exports. The industrial emphasis was directed at army and aircraft equipment which could be easily adapted to client requirements and which had a ready market in the oil-rich Middle East. Entrenched Brazilian businesses provided manufacturing and technical skills and proved adaptable for tank and aircraft production. The naval industry was placed on hold.

Third, the army continued to direct the country's industrial goals and the navy received less financial and industrial attention than the other service branches.

Finally, the decline in European navies due to the changing world situation coincided with the rise in Brazilian nationalism and desire to begin the drive toward becoming a great and influential power. As a maritime nation, Brazil followed the United States and Great Britain in understanding the need for a navy to project power and protect national interests. While Brazil purchased equipment, training and technology from abroad, attempts were made to strengthen indigenous naval industries and break the historical bond of naval dependence.

Lack of investment, lack of self-developed naval technologies, and difficulties in applying technological advances to navy industries still delay development. Modernization is sporadic and programs are interrupted or discontinued. It is difficult to convince a national or private shipyard to interrupt merchant ship construction and rearrange the assembly line to satisfy small, sporadic navy orders. [Ferreira, 1983, pp. 32-39]

Brazil's economies of scale affect production and concentration of naval assets in Rio de Janeiro overloads logistics and impairs management. Warships are expensive to produce. Developed maritime nations have large and busy shipyards and can product ships more cheaply. [Ferreira, 1983, pp. 32-39]

In light of the emphasis on protection of offshore resources, the 200 nautical mile exclusion zones, and perceived coastal patrol requirements, it is not surprising that the production of naval vessels is one of the most widespread endeavors of the developing arms producers such as Brazil. The most commonly produced and purchased naval system in Latin America is the coastal patrol boat, again reflecting the security requirements of the area and the relatively simply technology involved. [Moodie, 1979a, p. 18]

The rising international concern with arms trade and the possibility of political pressure may dim Brazil's desire to become a great power. The practices of "responsible pragmatism," and trading with anyone, are seen as irresponsible and Brazil may have to rethink its premise that its arms trade has nothing to do with its foreign power.

Some analysts believe that the division between industrialized and Third World countries will continue between arms producers, and that there is a growing stratification among Third World producers. However, increasing trade and technology transfer between Third World suppliers and recipients is already closing the division and leveling out the stratification. For example, technology trade agreements between Brazil and China, and Brazil and Saudi Arabia promise to transfer some very important and potentially destabilizing capabilities. The U. S. will not be able to stop these transfers.

Additionally, the trade between Brazil, China, and Saudi Arabia indicate that the quality of weapons may be improving. Up to now, the U. S. has kept ahead of the pack by virtue of the quality and capabilities of American weapons. As the second tier suppliers increase their trade, this edge may begin to erode. Such actions may actually increase the technological edge of the suppliers and recipients and narrow the gap between Third World countries and the industrialized world.

B. IMPLICATIONS FOR U.S. NAVAL SECURITY ASSISTANCE AND TECHNOLOGY TRANSFER POLICY

The desire to include Brazil in the U. S. Maritime Strategy necessitates a review and revision of current policies of naval technology transfer and security assistance to Brazil.

First, Brazil should again become eligible for security assistance from the United States. This eligibility could be as simple as ensuring the Brazilian Navy is first in line to receive the opportunity to purchase or lease naval equipment. Brazil has asked the U. S. for surface ships to replace the aging ships in the fleet and for advanced naval weapons systems. Brazil needs to modernize. If Brazil is incorporated into the Maritime Strategy, then she must have the capability and training to do so as a full partner. This means transferring naval technology that will allow Brazil to meet mission requirements. Potential missions could include basing, sea lines of communication protection, surveillance, and antisubmarine warfare, missions essential to any South Atlantic Maritime Strategy. Assisting the Brazilian Navy with equipment, training, and joint exercises ensures compatibility in operational and tactical areas. For the U. S. to expect Brazil to make do with less would be unwise.

Naval technology transfer policies should be reviewed with the goal of changing them to reflect the inclusion of Brazil into an American South Atlantic Maritime Strategy. Once missions have been defined, the technology transferred should complement these missions. Concern for the technology itself would be relieved once Brazil signed the GSOMIA.

Naturally, Brazil should be encouraged to sign the GSOMIA before receiving any technology. Brazil's agreement to sign would restore trust between the two countries and invigorate the relationship. Her willingness to cooperate would indicate a maturing toward foreign policy responsiveness and an awareness of her importance to the United States.

Building up the Brazilian Navy through security assistance and naval technology transfer will free up U. S. naval resources. The new budget constraints

suggest such interaction between the Brazilian Navy and the U. S. Navy will become even more important. The U. S. is stretching ever scarcer resources over widening areas. Any augmentation from other nations should be most welcome.

Brazil continues to show support for the U. S. The Brazilian Navy involvement in the UNITAS exercises this year (1988) reportedly include an aircraft carrier and more ship participation than earlier exercises. This renewed interest may lead to better integration of U. S./Brazil naval capabilities. The Bilateral Maritime Strategy Talks scheduled in September 1988 also illustrate Brazilian interest in cooperating with the U. S. in maintaining freedom of the seas in the South Atlantic.

The United States must look not only to its own interests, but must understand the views of the Brazilian government and its plans for its naval improvement. The U. S. is and should be concerned with continuing the excellent working relations between the two navies that existed for years. In terms of protecting the South Atlantic during a conflict with the Soviet Union, the Brazilian Navy's assistance would be invaluable, as has been historically illustrated. But beyond the advantage to the U. S., the Brazilians must be allowed sovereign control of their own destiny.

The lessons of the Falklands War are still fresh, and the Brazilian Navy wants a force of fixed-wing carrier-borne aircraft. Since their own carrier is unsuitable for this type of jet operation, the navy's choice will be to either purchase the V/STOL Sea Harrier from the U. S., which could be operated from the Brazilian carrier, or buy or build a replacement. [Howarth, 1985, p. 1426]

The U. S. can take advantage of this activity. Instead of retreating in the wake of Brazilian protectionism, the U. S. and the U. S. Navy should strive to use technology as a tool to gain increased influence. By assisting the Brazilian Navy,

REPRODUCED AT GOVERNMENT EXPEN

America can increase the compatibility between the two countries. Continuing the educational programs, ship visits, and joint exercises can foster good relations and improve understanding and the ability to work together.

The U. S. should be concerned with the growing reliance Brazil is showing on the European naval establishment. By moving away from the American Navy, Brazil may not only be changing her naval equipment, but may also be changing her naval tactics, operations, and orientation as well. Europe has less of a strategic interest in the southern Atlantic than the U. S. or Brazil. For the U. S., retaining a compatible and familiar association with Brazil should be a priority.

Brazil still feels that it needs access to the U. S. technology market to remain competitive and to continue its industrial modernization. The U. S. could use this desire to encourage increased trade and open new markets, in both the military and the civilian sector.

Latin America is important to U. S. national security. World Wars I and II taught this lesson. The growing concern over outside anti-American influence in the region reinforces the lesson as the instability draws closer. America needs Brazil as a friend, and Brazil needs America as an ally. Surely there is a common ground on which the two countries can meet. The era of "benign neglect" must end.

The U. S. still has the chance to build a strong and enduring partnership with Brazil. Though the future is uncertain, we would be foolish indeed to turn away.

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